AN: PAT 1992-202166
TI: Alarm system for warning of rotatable bearing overheating provides indication from monitor including e.g. piezoelectric transducer detecting audible click produced by thermally activated element contacting engaging portion
PN: **GB2250785**-A
PD: 17.06.1992
AB: The thermally activated engagement element (8) is mounted in close proximity to the bearing (4) and is retained in a borehole (13) in a mounting plate (6) by a C-shaped clip (14) end jaws (14a). The element includes a pin whose spindle (8b) is concentric around a memory coil spring (16) which engages, at one end (16a), the clip. If the bearing starts to fail, the heat generated is transferred to the element and causes the spring to extend. When the spring extends it pushes the pin out from the clip jaws to such an extent that it contacts the internal side wall (10) of the rotating roller (1) and strikes the engaging portion (12) mounted on the wall. The striking of this portion creates an audible clicking detectable by monitoring equipment.; Reduces risk of fire etc. from continued overheating in belt conveyors e.g. in underground coal mines, elevators, vehicles, machine tools, printers, etc.
PA: (HUWO-) HUWOOD INT LTD; (HUWO-) HUWOOD LTD;
IN: RICHMOND A;
FA: **GB2250785**-A 17.06.1992; AU9190424-A 08.07.1992; DE69109304-E 01.06.1995; EP560841-A1 22.09.1993; EP560841-B1 26.04.1995; ES2073276-T3 01.08.1995; US5315954-A 31.05.1994; WO9210690-A1 25.06.1992; ZA9109576-A 28.10.1992;
CO: AT; AU; BE; BR; CA; CH; DE; DK; EP; ES; FR; GB; GR; IT; JP; KR; LI; LU; MC; NL; SE; US; WO; ZA;
DN: AU; BR; CA; JP; KR;
DR: AT; BE; CH; DE; DK; ES; FR; GB; GR; IT; LI; LU; MC; NL; SE;
IC: F16C-000/00; F16C-017/24; F16C-019/52; G01K-001/02;
MC: X25-L06;
DC: Q35; Q62; T05; X25;
FN: 1992202166.gif
PR: GB0027013 12.12.1990; GB0023936 11.11.1991;
FP: 17.06.1992
UP: 01.08.1995

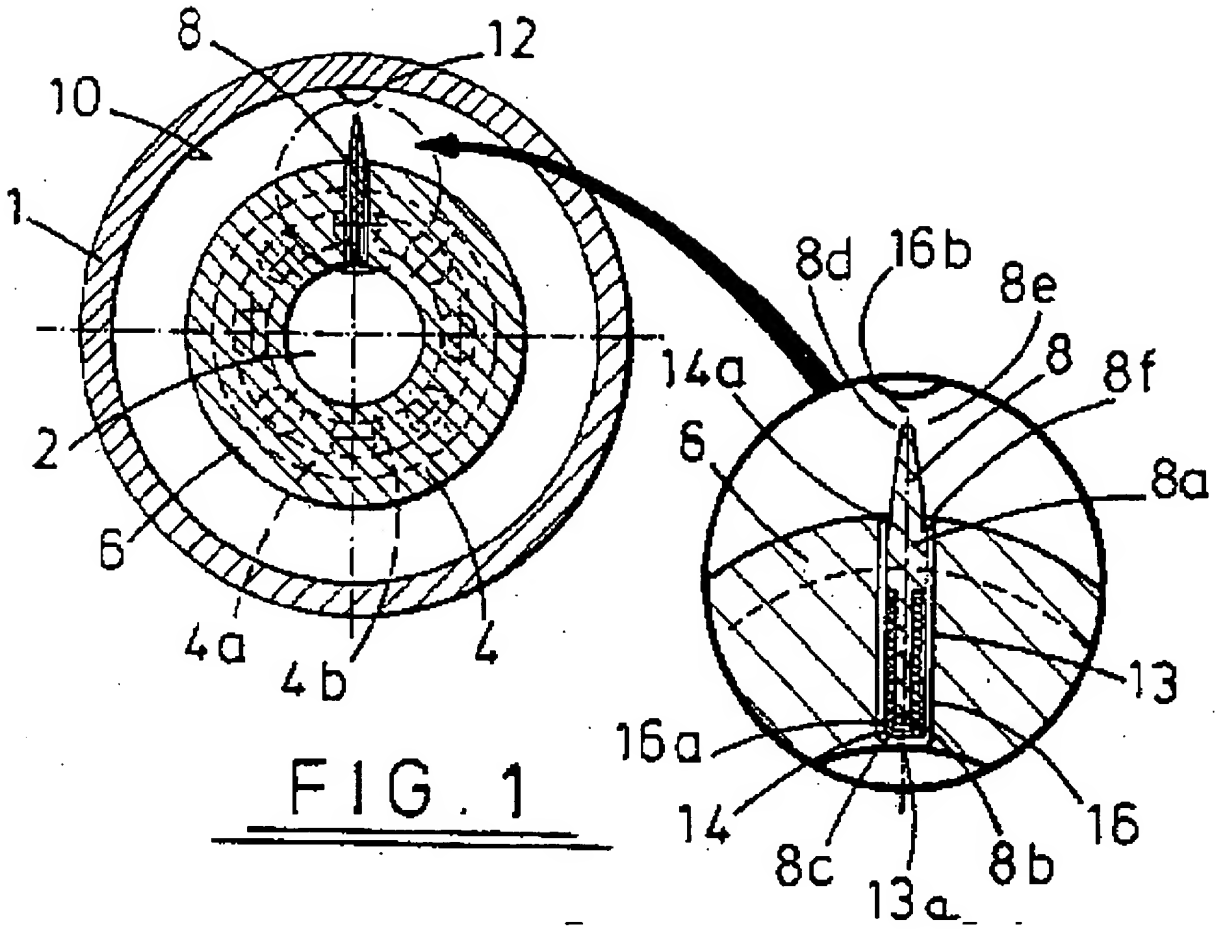

FIG. 1

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F16C 19/52

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U1S S1876

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GB 2155678 A GB 1599670 A

(58) Field of search
UK CL (Edition K) F2A AD34, G4N NCTX
INT CL[5] F16C
Online databases: EDOC; WPI

(54) Alarm system for bearings

(57) An alarm system for use in warning of overheating in rotatable bearings 4 comprises a thermally activated engagement element 8 on a first bearing portion or body 6 connected thereto. The element 8 is in thermal connection with the bearing 4 and is arranged so as to be driven from a first primed retracted position into a second deployed extended alarm position upon reaching a predetermined temperature. In the alarm position the element 8 contacts an engaging portion 12 on the second bearing portion 1 so as to produce a distinctive alarm signal such as an audible clicking, which may be detected by signal monitoring equipment. The element 8 may incorporate a bimetallic strip or spring, or a low melting point alloy plug.

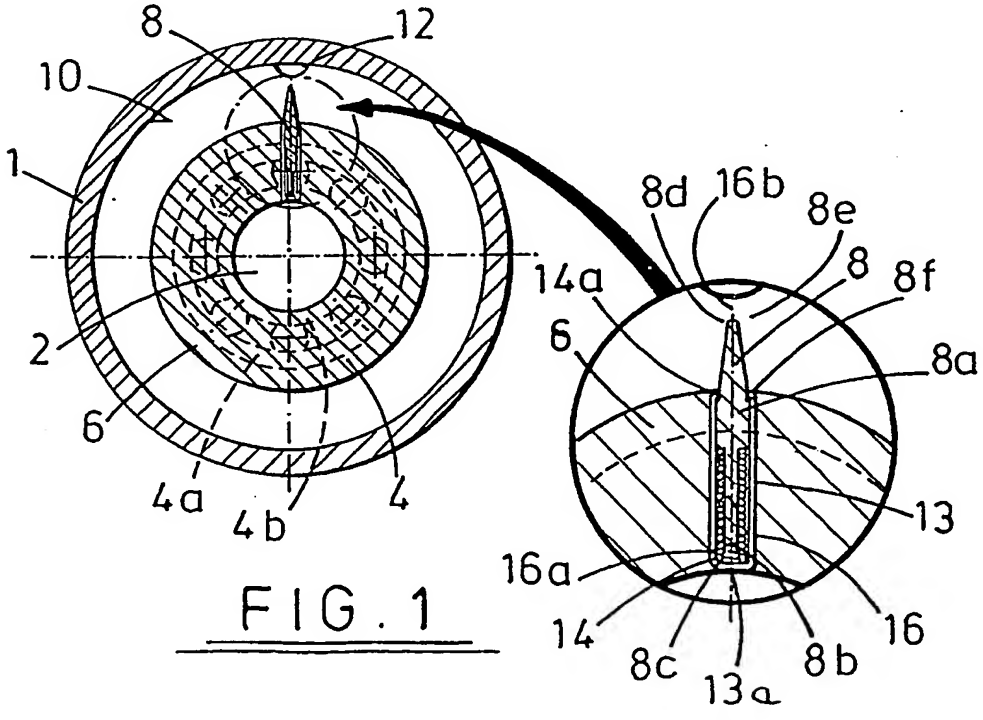

FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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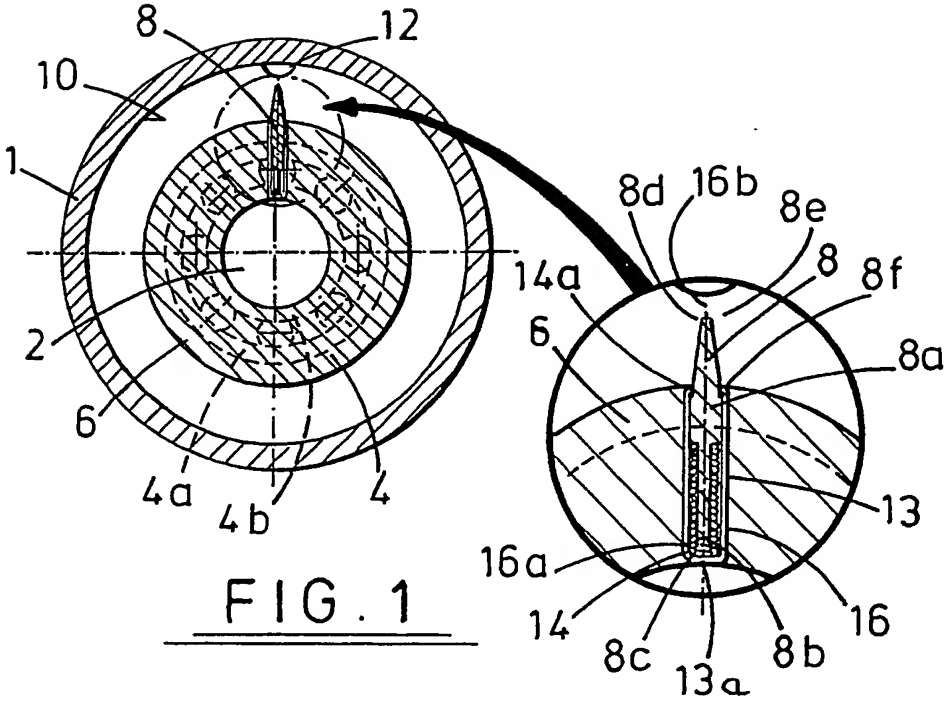
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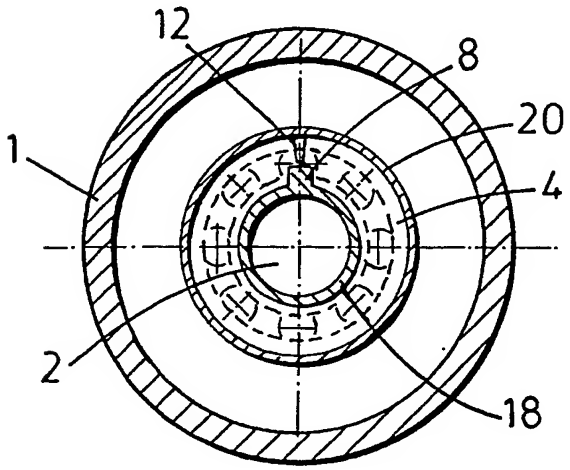
FIG. 1


12
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18

FIG. 2

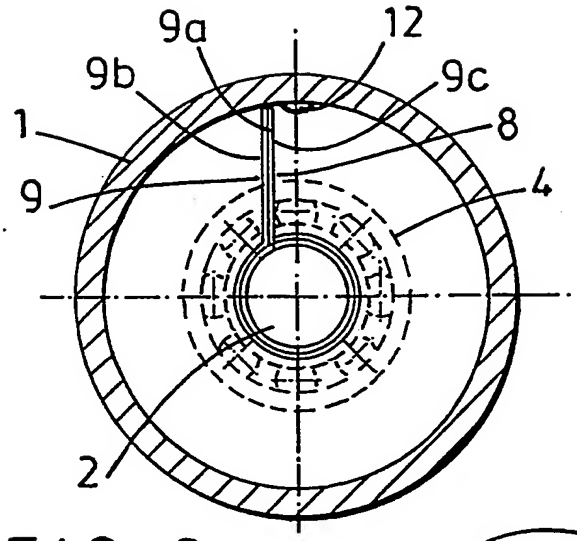

FIG. 3

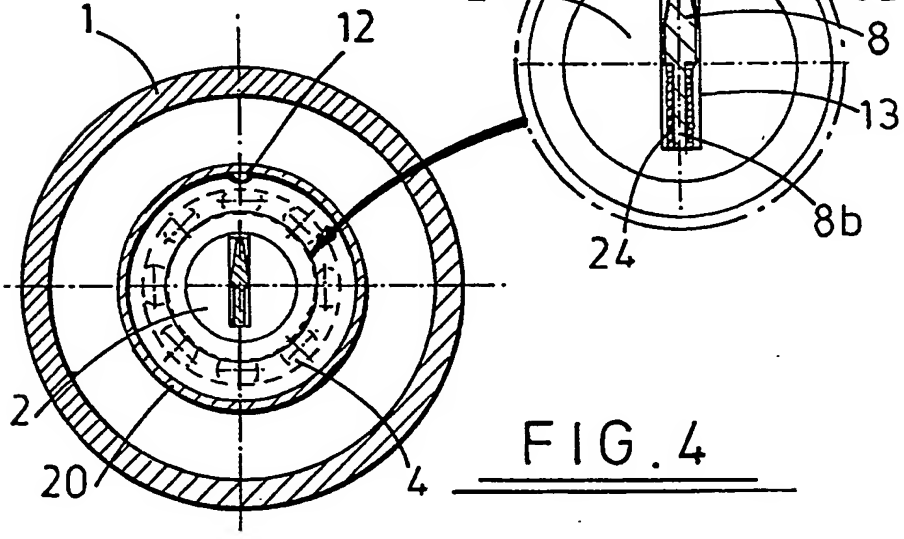

FIG. 4

ALARM

The present invention relates to an alarm system suitable for use with rollers and other rotary mechanisms having relatively rotatable parts with a bearing therebetween.

The invention relates particularly to a device which gives an indication that a bearing is overheating and thereby gives an early indication of possible bearing failure. When a bearing is contaminated by dirt or moisture and/or is rotated with insufficient lubricant or an excess or lubricant and/or is overloaded, the bearing temperature generally increases progressively until eventually it is well above the normal working temperature of the bearing. Such increases in temperature are generally a sympton of impending bearing collapse or seizure which may cause damage to other components in a machine. Furthermore as a bearing overheats it may reach a temperature whereby it ignites surrounding material and it is therefore highly desirable to obtain early warning of such problems.

Conventional monitoring of rollers bearings by maintenance personnel or by instrumentation has generally been found to be either impractical or prohibitively expensive.

It is an object of the present invention to avoid or minimise one or more of the above disadvantages.

The present invention provides an alarm system suitable for use in warning of overheating in rotatable bearings comprising first and second bearing portions, said alarm system comprising an alarm signal generator means having a thermally activated engagement element provided on a first bearing portion or on a body connected thereto so as to be in thermal connection with said bearing portion and formed and arranged so as to be driven upon reaching a predetermined elevated temperature from a first primed retracted position into a second deployed extended alarm position for contacting with an engaging portion provided on a second bearing portion or body connected thereto during relative rotation between said first and second bearing portions and formed and arranged so as to produce together therewith a distinctive alarm signal, indicating that said bearing has exceeded said predetermined temperature, when said engagement element is brought into contact therewith.

It will be appreciated that various forms of alarm signal generator means may be used in accordance with the present invention. Thus there may be used a signal generator means having an engaging portion in the form

of one or more generally radially extending projections on said second bearing portion or body connected thereto which is (are) periodically struck by the deployed engagement element as the bearing portions rotate relative to one another, so as to produce a form of more or less audible "clicking" sound, at least one of the engagement element and the projection(s) preferably being resiliently deflectable so as to permit continued alarm signal generation over an extended period of time without damage to the parts. The "clicking" sound could moreover be a more or less loud acoustic signal which could be directly auditorily sensible or via suitable audio transmission, amplification and/or relay means. Alternatively there could be utilised a "clicking" detectable by piezo-electric transducer means or other suitable apparatus for detecting non-audible form alarm signals.

In yet another alternative there could be used an engaging portion in the form of an at least partially circumferentially extending surface which upon frictional contact with the engagement element provides a distinctive screeching or like sound.

Thus with an alarm system of the present invention an alarm signal is given upon overheating of a bearing in use of the system so that said overheating bearing may

be readily detected and replaced thereby minimising the risk of fire etc. from continued overheating.

One especially useful application of the present invention is to the rollers of belt conveyors, including both idler and driving rollers, particularly for use in potentially hazardous environs such as underground coal mines and the like. The alarm system of the present invention has many other applications, though, in rotary bearings in machinery used in the petrochemical industry, automobiles, elevators, lifts, machine tools, strips, docks, sugar and grain processing, manufacturing, printing, the gas industry etc.

It will be appreciated that various forms and methods of activating and driving said thermally activated engagement element may be employed. Thus for example a bi-metallic strip, a bi-metallic spring or other combinations of at least two elements of materials having different coefficients of expansion may be used as well as a memory metal, a memory strip or spring or other material having shape memory characteristics, may be used wherein the activation and the driving of said engagement element are integrated into a single component. In another form, the activation and the driving functions of said engagement element may be performed by separate means, for example the driving of

the engagement element may be by a pre-stressed resilient biasing means e.g. an helical coil spring, which is retained in place by a low melting point alloy plug, wherein the melting point of said alloy plug corresponds to said predetermined elevated temperature, so that when said plug melts it releases the resilient biasing means so as to drive said engagement member into a deployed alarm position.

The engagement element thermal activation means may be formed and arranged for activation at any suitable temperature, conveniently a temperature in the range from 60° to 110°C, for example at a temperature of about 70°C.

Preferably said distinctive alarm signal is an acoustic signal which may be readily detected by signal monitoring equipment for activation of (conveniently remotely situated) suitable alarm means such as warning bells, sirens, klaxons etc. and/or warning lights such as flashing lamps, l.e.d.s etc.

Desirably said alarm signal is an audible signal which may be readily detected directly by any personnel in the vicinity of equipment equipped with an alarm system of the invention.

It will be understood that bearings in normal use will cause a certain amount of background noise (which may be acoustic in nature and/or in the form of periodic mechanical strain), however, in accordance with the present invention a failed bearing will produce a distinctive warning signal in a generally stepwise increment above any background noise and which thus may be readily detected.

Further preferred features and advantages of the present invention will appear from the following detailed description given by way of example of some preferred embodiments illustrated with reference to the accompanying drawings in which:-

Fig. 1 is a cross section through an idler roller showing a first embodiment of the bearing alarm system (inset) of the invention;

Fig. 2 is similar to Fig. 1 but shows a second embodiment of the alarm system;

Fig. 3 shows a third embodiment of the invention; and

Fig. 4 is a view similar to Figs. 1-3 but shows a fourth embodiment of the bearing alarm system (inset) of the invention.

Fig. 1 shows a rotary mechanism in the form of a driveless idler roller generally indicated by reference number 1 such as is used to support the moving belt (not

shown) of a belt conveyor. The roller 1 is rotatably mounted on a fixed shaft 2 by rotary bearings 4 (shown in dashed line). Adjacent the bearing 4 and also mounted on the fixed shaft 2 is a mounting plate 6 which supports a thermally activated engagement element 8 in the form of a pin having a short generally cylindrical body 8a with an elongate spindle 8b at one end 8c and a flexible tapering end portion 8d at its other end 8e which end portion 8d projects outwardly of the borehole 13 and has a maximum diameter slightly less than that of the body 8a so as to form a shoulder 8f at said other end 8e of the body 8a. The engagement element 8 is mounted in close proximity to the bearing 4 so as to be in thermal connection therewith. An internal side wall 10 of the roller 1 has an engagable portion in the form of a protrusion 12 extending radially inwardly from the roller 1.

Under the normal operating conditions of the roller 1, the engagement element 8 is retained in a borehole 13 in the mounting plate 6 by a retaining clip 14 (See inset). In more detail the retaining clip 14 is generally "C"-shaped with opposed free end portions forming jaws 14a which engage the shoulder 8f at opposite sides of the pin 8 to hold the body 8a in the borehole 13. The spindle 8b of the pin 8 has disposed concentrically therearound a memory coil spring 16

having one end 16a engaging spring clip 14 at the base 13a of the borehole 13, and its other end 16b against said one end 8c of the pin body 8a. Should the bearing 4 start to fail heat is generated which is transferred to the engagement element 8. The memory spring 16 is formed and arranged so as to extend to its original size when an elevated temperature indicative of likely bearing failure and/or a likely fire hazard in the immediate environment, is reached. As the spring 16 extends it forces apart the jaws of the retaining clip 14 and drives the engagement element 8 partially out of the stationary plate 6 into contact with the internal side wall 10 of the rotating roller 1 and the protrusion 12, which strikes the engagement element 8 causing an acoustic or audible vibration for detection by detection equipment (not shown) or by operating personnel.

Figs. 2-4 show alternative forms of the alarm system of the invention and will be described with reference to the embodiment in Fig. 1 and indicated by like reference numbers.

The fixed shaft 2 has a memory metal ring 18 attached to it which, has an engagement element 8 extending therefrom. The outer rotatable portion 20 of the bearing 4 has a protrusion 12 extending radially inwardly therefrom. In normal working conditions the

protrusion 12 and the element 8 do not touch, however should the temperature of the bearings 4 increase above a predetermined value due to failure of the bearing 4 the ring 18 expands so as to bring the engagement element 8 into contact with the rotating protrusion 12 so as to generate an acoustic alarm signal by periodic striking of the engagement element 8 against the protrusion.

In Fig. 3 the engagement element 8 is in the form of a bi-metallic strip attached to the fixed shaft 2 which when overheated above a predetermined value straightens so as to expand in a radially outward direction into contact with said protrusion 12 thereby causing noise and vibration which may be detected by suitable equipment or operating personnel.

Fig. 4 shows another embodiment of the system wherein the outer part 20 of the bearing 4 has an engagement portion in the form of an inwardly projecting protrusion 12. The engagement element 8 is generally similar to that in the embodiment of Fig. 1 and is mounted inside a generally diametrically extending borehole 13 in the fixed shaft 2 (see inset) and is sealed therein by a fusible metal alloy plug 22. Should the bearing 4 fail and start to overheat, the fusible plug 22, will at a predetermined temperature melt and the engagement

element 8 be forced out into contact with the rotating protrusion 12 by a helical spring 24 disposed around the spindle 8b of the engagement element 8 similarly to the arrangement in Fig. 1 albeit in this case the biasing force exerted by the spring 24 will be generally constant during operation of the system. As the bearing rotates the projecting tapering end portion 8d periodically strikes the protrusion so as to generate a noise and vibration that may be detected.

CLAIMS

1. An alarm system suitable for use in warning of overheating in rotatable bearings comprising first and second bearing portions, said alarm system comprising an alarm signal generator means having a thermally activated engagement element provided on a first bearing portion or on a body connected thereto so as to be in thermal connection with said bearing portion and formed and arranged so as to be driven upon reaching a predetermined elevated temperature from a first primed retracted position into a second deployed extended alarm position for contacting with an engaging portion provided on a second bearing portion or body connected thereto during relative rotation between said first and second bearing portions and formed and arranged so as to produce together therewith a distinctive alarm signal, indicating that said bearing has exceeded said predetermined temperature, when said engagement element is brought into contact therewith.

2. An alarm system as claimed in claim 1 wherein said thermally activated engagement element is provided with driving means which driving means comprises resilient biasing means formed and arranged for urging the engagement element from said primed position towards said alarm position.

3. An alarm system as claimed in claim 1 or claim 2 wherein said thermally activated engagement element is provided with thermal activation means in the form of a fusible element formed and arranged for retaining said engagement element in said primed position, said fusible element being fusible at said predetermined elevated temperature thereby to release said engagement element so as to be deployed into said alarm position.

4. An alarm system as claimed in claim 1 or claim 2 wherein said thermally activated engagement element is provided with thermal activation means in the form of a latch means of a material having shape memory characteristics formed and arranged for retaining said engagement element in said primed position, and changing its shape at said predetermined elevated temperature so as to deploy or allow deployment of, the element to its alarm position.

5. An alarm system as claimed in claim 1 wherein said thermally activated engagement element comprises a thermally variable configuration member having a first configuration at a normal bearing operating temperature, and a second, significantly different, configuration at and above said predetermined elevated temperature, said member having a distal portion which is spaced from the

engaging portion in said first configuration, and positively contacts said engaging portion in said second configuration.

6. An alarm system as claimed in claim 5 wherein said thermally variable configuration member has a first portion of a material having a first coefficient of expansion joined to a second portion of a second material having a second, different, coefficient of expansion so that the configuration of said member changes when the temperature thereof traverses said predetermined elevated temperature.

7. An alarm system as claimed in claim 5 or claim 6 wherein said thermally variable configuration member is a bimetallic strip.

8. An alarm system as claimed in claim 5 wherein said thermally variable configuration member is of a material having configurational memory characteristics.

9. An alarm system as claimed in claim 8 wherein said thermally activated engagement element is of a plastics material having shape memory characteristics.

10. An alarm system as claimed in any one of claims 1 to 9 wherein said engaging portion is in the form of at

least one generally radially extending projection which is periodically struck by the deployed thermally activated engagement element, in use of the system, as the bearing portions rotate relative to one another so as to provide said distinctive alarm signal.

11. An alarm system as claimed in claim 10 wherein at least one of said engagement element and said projection is resiliently deflectable upon striking therebetween so as to permit extended alarm signal generation.

12. An alarm system as claimed in any one of claims 1 to 9 wherein said engaging portion is in the form of an at least partially circumferentially extending surface which upon frictional contact with said engagement element provides a distinctive screeching or like sound.

13. An alarm system as claimed in claim 1 which includes apparatus for detection, transmission, amplification and/or relay by electronic means, of said distinctive alarm signal in use of the alarm systems.

14. An alarm system as claimed in claims 2 and 3 wherein said engagement element comprises a pin means mounted in a borehole with a resilient biasing means in the form of an axially compressible spring disposed in the borehole for acting between the borehole and the pin

means so as to urge the pin means in a direction outwardly of the borehole, so that, upon release of the pin means by fusing of the fusible link, a flexible distal end portion of the pin means projects outwardly of the borehole for periodic striking engagement with an engaging portion in the form of a generally radially extending projection, thereby to produce a said distinctive alarm signal.

15. An alarm system substantially as described hereinbefore with particular reference to any one of Figs. 1 to 4 of the accompanying drawings.

16. An endless conveyor having a plurality of drive and/or idler rollers, said rollers being provided with alarm systems according to any one of the preceding claims.

Patents Act 19[redacted]
Examiner's report to the Comptroller under Section 17 (The Search Report)

A[redacted]cation number 9027013.3

Relevant Technical fields

(i) UK Cl (Edition K) F2A (AD34); G4N (NCTX)

(ii) Int Cl (Edition 5) F16C

Search Examiner

B B CASWELL

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: EDOC; WPI

Date of Search

5 MARCH 1991

Documents considered relevant following a search in respect of claims 1-16

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB A 2155678 (OY WARTSILA) see whole document	1-3, 13,14
X	GB 1599670 (NRDC) see whole document	1-3, 14,16

Category	Identification of document and relevant passages	Relevant to claim(s)

Categories of documents

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Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

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P: Document published on or after the declared priority date but before the filing date of the present application.

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